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OVERVIEW OF INTERACTIONS OF CHEMICALS WITH THE SKIN

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Healthy normal skin functions primarily as an organ of protection and helps maintain homeostasis. Because the skin is an organ in direct contact with the environment, it is susceptible to chemical insults. The annual expenditure in the United States for occupational dermatitis may exceed a quarter of a billion dollars. In the study of mechanisms underlying some of the phenomena in environmental skin disease, information has been collected on percutaneous absorption of a number of drugs and simple chemicals but not on most environmental penetrants. Research on the barrier function of skin and how molecules penetrate it has been meager. Systematic development of models for the study of percutaneous absorption is needed. The effects of a host of variables on skin penetration need further study. With this information, new methods could be developed to prevent penetration of toxic chemicals into the skin.

When a chemical comes in contact with the skin it can evaporate or be removed physically (e.g. abrasion) from the skin or it can penetrate into the skin. There are several factors that in part determine its fate. The physical-chemical properties of the penetrant molecule (molecular size, volatility, partition coefficient, etc.) comprise one group of factors. A second group is the skin's properties (anatomic site, metabolic activity, etc.). Ambient conditions comprise a third group of interrelated factors which influence the structure and function of the skin. Included are environmental factors (air, temperature, and humidity), pharmacological effects of systemically or topically applied chemicals, and the effects of the body's homeostatic control mechanisms.

In dealing with the interrelationship of chemicals and the skin, a model or conceptual framework is necessary to bring together all the various factors affecting the fate of the chemical. Modeling studies to date have been based on permeability experiments with limited numbers of compounds, usually studied at

a single dose. They have generally ignored evaporation or physical removal from the skin surface and have ignored the effects of enzymes and degradation in the skin. The relative importance of different routes of penetration rests on indirect evidence. A need, therefore, exists to study the selective permeability of the skin and to quantitatively predict penetration rates in terms of the physical-chemical properties of the penetrant, the biological properties of the skin, and the conditions of exposure.